

**CONSTRUCTION MANAGEMENT EDUCATION IN CANADA:  
THE HISTORY OF THE ESTABLISHMENT OF ONTARIO'S FIRST  
BACHELOR'S DEGREE IN CONSTRUCTION MANAGEMENT**

**A Paper  
Submitted to the Graduate Faculty  
of the  
North Dakota State University  
of Agriculture and Applied Science**

**By**

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**In Partial Fulfillment of the Requirements  
For the Degree of  
MASTER OF SCIENCE**

**Major Department:  
Construction Management and Engineering**

**December 2010**

**Fargo, North Dakota**

North Dakota State University  
Graduate School

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Title

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## **ABSTRACT**

Durazno, Herman, M.S., Department of Construction Management and Engineering, College of Engineering and Architecture, December 2010. Construction Management Education in Canada: The History of the Establishment of Ontario's First Bachelor's Degree in Construction Management. Major Professor: Dr. Charles McIntyre.

This study examines the establishment of the first construction science and management degree program in Ontario. It illustrates the circumstances that led the Ontario construction industry to recognize the need for such an undergraduate degree program and to seek an educational institution as a partner in the planning, development and establishment of the undergraduate program. The paper displays how the industry faced obstacles such as a plan to regulate the industry by the Ontario government and the lack of incoming construction management degree professionals from overseas. In addition, the paper displays the differences between existing engineering technology diplomas and the new bachelor degree in construction management and why the degree option will be beneficial to new students as well as graduates of the engineering technology diploma program. Finally, it displays how the Ontario construction industry leadership and reactivity was the major factor in the establishment of the program and how industry participation and involvement is a key component in the success of undergraduate degree programs in construction management.

## **ACKNOWLEDGEMENTS**

The author wishes to express his gratitude to his wife for all the time and energy she contributed to see him fulfill his educational and career aspirations. Special thanks to Dr. Charles McIntyre as both advisor and committee chair for his patience, persistence and help with the many revisions. Special thanks to Mr. Bill Nichols for taking the time to sit with the author and provide the valuable information that makes up most of this paper. The author also wishes to express thanks to his Mother, who instated in him the value of a good education. The author also acknowledges those who helped proofread and give advice.

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## CHAPTER 1. INTRODUCTION

When people think about a career in construction, they usually think demanding physical work, harsh working conditions and dangers present in most construction sites. What many do not realize is that there is much more to construction, than the skills trades when looking for a career in construction. The skills trades are just one part of the equation.

Behind every construction project there is a management team comprised of project managers, superintendents, and project engineers that have the responsibility of making each project, safe, profitable and completed within a set schedule. “Construction as an industry is one of the largest economic driving forces in the city of Toronto, the province of Ontario and Canada. (GBC, 2005)” “The industry employs almost three times as many workers in Ontario, than the automobile industry, approximately 450,000 people or about six percent of Ontario's workforce. (GBC, 2005)”

“Construction management education can be defined as a mixture of, construction science, management and engineering; designed meet the requirement for talent of this rapidly growing industry” (NDSU, 2007). “Construction management educational programs have been created, with the goal to produce graduate construction managers for the construction industry that can maximize profits by the proficient use of various resources in order to successfully execute construction of a project as required by schedule, budget and expectations of the owner. (NDSU, 2007)”

### **1.1. Problem Statement**

In the province of Ontario, until very recently, you could not study construction management at the undergraduate degree level, simply because such a program did not exist. “In the year 2000 the Ontario construction industry faced two challenges that forced it and its members to evaluate the need for a degree program in construction management. (Nichols, 2009)

### **1.2. Research Objectives**

The research objective for the paper is to exhibit the factors that pressed the Ontario construction industry into the forefront of planning, developing and establishing a bachelor degree program in construction management.

### **1.3. Research Methodology**

The research methodology for this paper will be to use existing data, reports and articles related to the development of construction education in Canada. As part of the methodology, a formal definition and description of the available diploma programs in construction engineering technician/ technology will be made. In addition, specific data will be collected and analyzed to display the circumstances that brought the requisite for undergraduate construction management education into the forefront of the Ontario construction industry and how this affects existing construction diploma programs.

In order to provide a clear picture of the base point used in developing the program; an assessment of the “Chartered Institute of Building (CIOB) educational framework (CIOB, 2007)” will be made. As well as, a review of the formal application package submitted by the Toronto Construction Association and

George Brown College for approval to the provincial government will be reviewed and analyzed.

By collecting the data and reports, a timeline of events will be created which will display the necessary steps taken by the industry and the faculty involved in the development. The review of this data is necessary, for the development of an accurate description of the circumstances that took place as part of the development of the construction management program.

Journals, reports and magazine articles information will be reviewed, analyzed and applied in conjunction with the methodology of the research for this paper. This valuable data and research will help display accurate background information on construction management education; such as its definition, its current state in other countries other than Canada, especially the U.S.

All this information will be the basis of the research methodology and will provide a clear picture of the current state of construction management education in Canada and more specifically Ontario.

## **CHAPTER 2. LITERATURE REVIEW**

### **2.1. Background Information**

“Construction management education is a mixture of many disciplines that come together to provide graduates with a solid education and skills, that can be applied to the management of construction. (NDSU, 2007)” “It is goal is to educate graduates that are ready for a career in managing the construction process and achieving maximum profits by combining various resources and materials to successfully complete a project. (NDSU, 2007)”

The mission of construction management degree programs, are to provide quality educational programs that prepare students for a prosperous profession in as a construction manager. The programs have been developed with the intention to educate and provide the students with educational, research as well as professional opportunities that can benefit the profession and graduates.

Construction management degree programs objectives are:

- Provide necessary basic skills to schedule and control the construction process.
- Provide sound technical understanding necessary for managing the construction process.
- Instruct awareness and abilities necessary to identify, delineate and equate options in design.
- Instruct the very necessary communication abilities for a prosperous career in the industry.

“Construction management graduates are in high demand by various companies in all the different fields of the industry; with a broad range of career options available with great starting salaries. (NDSU, 2007)”

## **2.2. Construction Management Education in Canada**

Canada has very few colleges offering degree programs specializing in construction management. Only the British Columbia Institute of Technology (BCIT) offers a specific degree program in construction management.

“Traditionally programs relating to construction management are available largely through studies in other specialized degree programs (e.g., Civil Engineering or Architectural Science degree programs) or through two and three-year diploma programs (e.g., Construction Engineering Technician or Construction Engineering Technology and Civil Engineering Technology). (Nichols, 2009)”

In Canada traditionally, there has been a difference between a college and a university education. A college diploma is a degree granted by a college after two years or three years of education; whereas a bachelor’s degree is a degree granted by a university after four years of education. The difference between the diploma and the bachelor; is not partial to the time spent at the college or university, but can also include differences in job opportunities, salary amounts and job opportunities.

In the 1960s in Ontario, the new occupational category of technician and technologist was established along with an emerging system of community colleges and technical institutes. It was designed to successfully close the gap

between engineering degrees with their increasingly theoretical nature and the predominately practical approach of technician, technologist and trades programs.

### **2.3. Construction Engineering Technology, Three Year Diploma**

“The technologist diploma program provides graduates with a mixture of skills which include technical, business and interpersonal; that are required to effectively manage construction projects of varying complexity and size. (GBC, 2005)” Students gain knowledge of the different levels of the construction industry and its practices, including project and site management, contracts and specifications, quantity surveying, estimating and bidding as well as project control and scheduling and construction law. (GBC, 2005)”

### **2.4. Construction Engineering Technician, Two Year Diploma**

“The technician diploma program provides students with a basic understanding of construction contracts and documents, on-site building engineering, safety, quantity surveying, technical knowledge and building codes. (GBC, 2005)” “The individualities of various building types are studied with an appreciation for energy and environmental technologies. (GBC, 2005)” Students will participate in laboratory courses which provide practical building layout surveys, testing building materials and quality control. Students will also gain extensive computer proficiency, working with specialized industry software. (GBC, 2005)”

### **2.5. Certification Options for Two and Three Year Diploma Graduates**

“Graduate technologists and technicians can be certified as a technologist or technician and are acknowledged by the following title, “Certified Engineering

Technologist (C.E.T). (OACETT, 2005)” or “Certified Technician (C. Tech). (OACETT, 2005)”

“A C.E.T evaluates assignments, establishes objectives as well as defines and solves problems. From conception to completion they see a project through all the stages or concentrate on a project’s specific area. Technologists act in leadership roles as well as managerial and provision roles; often training, supervising and coordinating other members of the professional team and staff. (OACETT, 2005)”

“A C.Tech normally uses hands on approaches established upon a comprehensive knowledge of their areas; technicians study their projects, goals and instruction and set to work to resolve issues. It is a definite knowledge that allows them to be dedicated and often play a crucial role in supporting the engineer and the C.E.T. (OACETT, 2005)”

## **2.6. The Chartered Institute of Building**

“With a large member base spanning all the major continents, this organization is the most prominent transnational professional body for construction managers. It sets the global pace for the competence and education of professional construction managers. (CIOB, 2007)”

“In 1834, the CIOB was instituted with the principles of maintaining quality standards in construction management, which still are part of the institute to this day. (CIOB 2007)”

## **2.7. CIOB Educational Frame Work (Syllabus)**

“The CIOB and the Institute have established criteria for membership that has developed a framework of educational requirements, created to reflect the industry needs and provision. (CIOB, 2007)”

“The Educational framework of the CIOB is a comprehensive document which establishes the core standards required of construction education. (CIOB, 2007)” “It’s continually revisions and reviews are intended to guarantee significance and application to the progressively moving needs of the industry, which is continually developing. (CIOB, 2007)” “The CIOB and its framework main purpose are to provide the baseline of educational results required during program delivery as well as to ensure a dependable method to the application of its main components: (CIOB, 2007)”

- Construction Technology & Environment
- Specialism & Skills

“Thru the emphasis of outcomes the learning framework is structured in three different levels. (CIOB, 2007)”

“Thru the combination of the modules, the context will be progressively developed through the three different levels of education. This will enable the students to develop skills in construction technology and environment, highlighting the specialism and representation of the breadth of skills. (CIOB, 2007)” “Flexible time limits between these various levels of components have been created with appropriate rationalization. (CIOB, 2007)”



“In Table 1, on page 14 the “CIOB educational frame work (CIOB, 2007)” is presented and provides a preview of “how these modules can be sequenced through the various learning levels of a program. (CIOB, 2007)”

## **2.8. The Industry Determines the Need and Demand for a Construction Management Degree Program**

The Toronto construction industry (TCA), in the true essence of collaboration as a full partner in the development process; the TCA offered facilities, human resources and significant volunteer time. The TCA has a membership pool of 1,800 which represents small, medium and large contractors, suppliers, architects, engineers, consultants, financial institutions and insurance companies. In 2003, the key finding of this survey are reflected in the following statements. (Note: “CM’ in this survey refers to individuals working as Construction Managers, Estimators, Site Administrators, Site Superintendents, Project Managers, Project Coordinators, Project Estimators, Supply, Sales, Technical Representatives, and other related occupations.) (GBC, 2004)

Below is a summary of the surveyed responses gathered from the survey performed by the Toronto Construction Association:

- 147 survey respondents (8% response rate)
- 144 firms currently employ 34,530 people, with 133 of these firms employing 2,257 CMs (6.5% of total employment in the survey sample).
- Over the past 3 years, employment growth has been positive, increasing from 1,607 CMs in 2000 to 2,257 in 2003 (up by 40%).

- In comparison to the average employee, CMs are more likely to work full-time (81% vs. 63%) and on contract (17% vs. 3%), and are less likely to work part-time (2% vs. 34%).
- Close to 2 out of 3 respondents (N=123) reported having difficulties hiring CMs during the past 3 years. Lack of work related experience (86%) and formal training or education (64%) were the two most common reasons cited by 73 respondents.
- The employment outlook for CMs to 2006 is positive; as employment is expected to increase at an annual average rate of 9.6% (respondents estimated that their firms will hire over 1,100 CMs by 2006).
- Almost one-tenth of these new hires will be as a result of retirement (121 CMs are expected to retire by 2007). Firms cited college education (71% of respondents) as the most common educational requirement when hiring CMs, followed by certification (35%), and apprenticeship training (32%).
- Once CMs are hired, they are encouraged to continue to upgrade their skills. In fact, 76% of firms (N=126) offer some kind of training/learning opportunities to their CMs.
- The top 3 training/learning opportunities currently being offered by 98 firms include workshop/seminars (86%), continuing education at colleges/universities and/or other educational institutions (51%), and vendor training courses (42%).

Figure 1 - Top 5 Skills/Knowledge Rated by 133 Respondents as "High Priority"

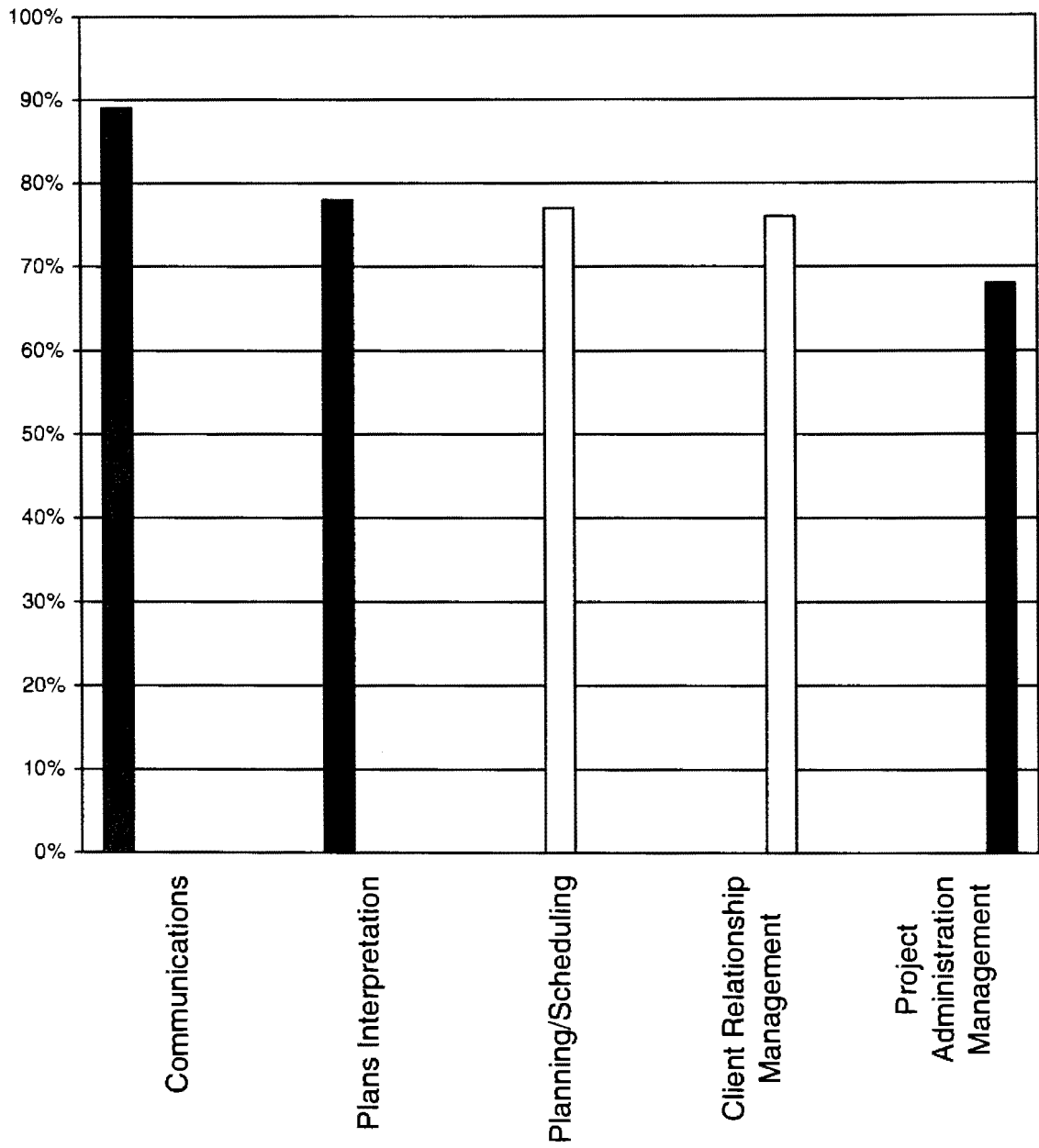
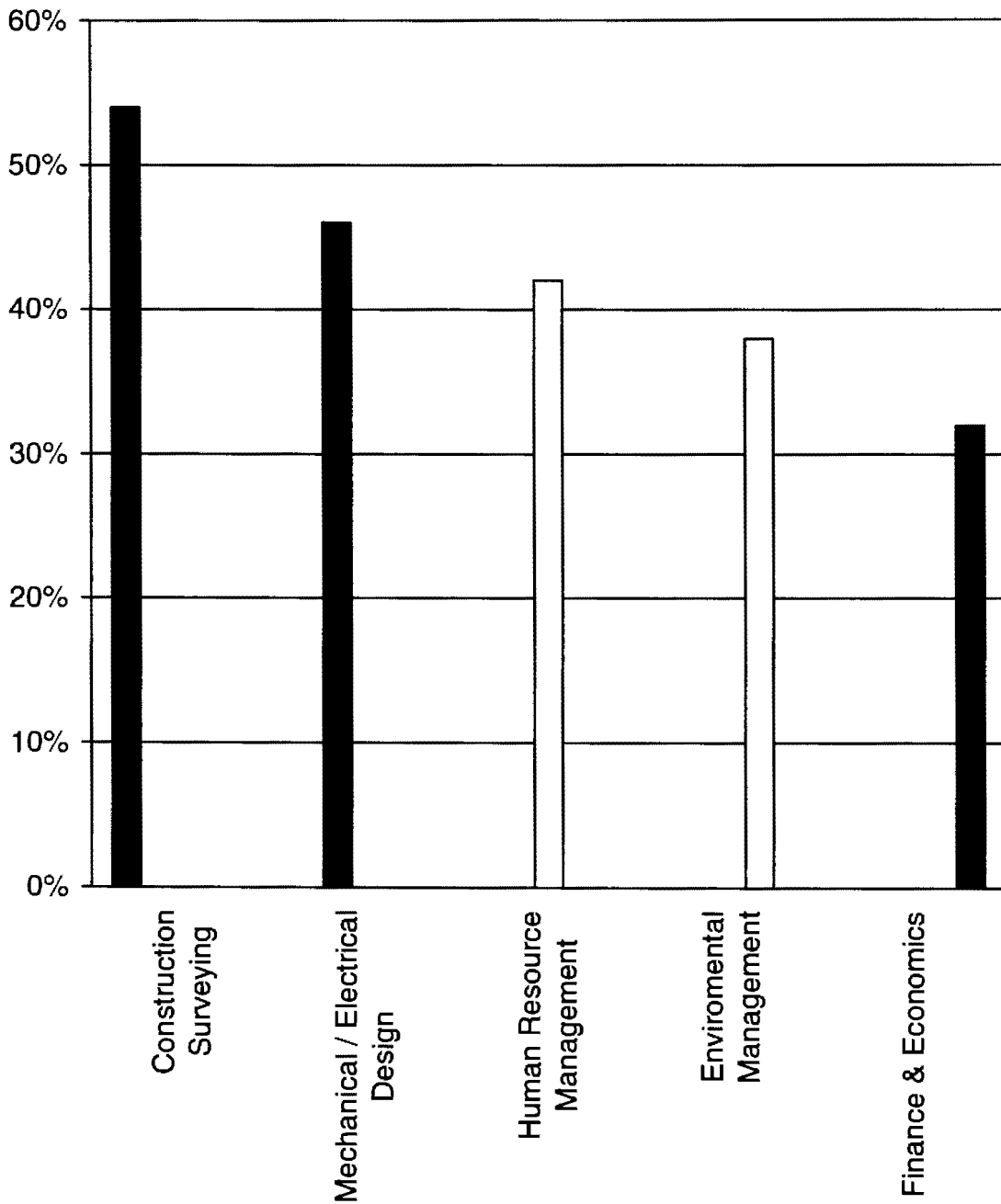


Figure 2 - Top 5 Skills/Knowledge Rated by 118 Respondents as "Low Priority"



**Table 1 - CIOB Educational Framework.**

Indication of balance of components during learning programs

Level 3: Combination/Assessment by subject incorporations.

Construction Knowledge	Construction Environment & Management	Concentration	Expertise
Level 2: Study & Practice			
Construction Knowledge	Construction Environment	Concentration	Expertise
Level 1: Values & Framework			
Construction Knowledge	Construction Environment	Concentration	Expertise

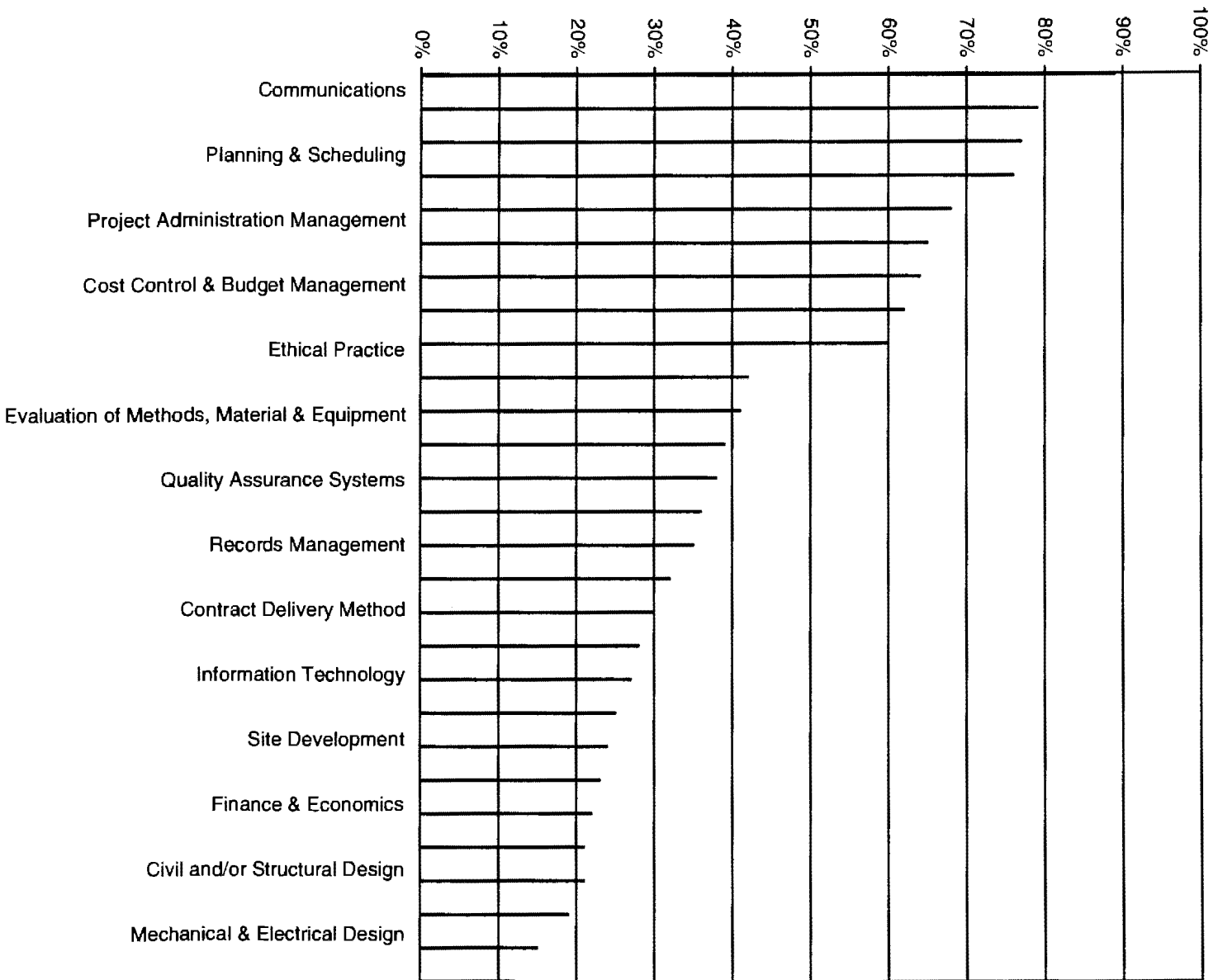
Since in Ontario no other similar program exists, that permits the recognition by other institutions of this credential. However, extensive research was conducted in concert with the Toronto Construction Association (TCA) to verify the absolute need for this degree program. The TCA is the largest association in Canada representing the construction sector. Highlights of the survey that address the consultation with industry are below:

- Over 1600 companies were sent the survey and 147 (8%) responded.
- Fully all respondents indicated a need for this type of program based on factors such as: Technology changes in the industry
- No pool of qualified professionals exist with the range of academic preparation offered by this program
- Training to meet internal company requirements is either done in house, through consultants or by the creation of specialized courses using college or university resources
- The demand for qualified and “construction engineering/management” professionals is increasing in Canada and is evident in other off shore jurisdictions
- Advancement opportunities for employees are limited and require extensive training

“Based on the finding results of the two surveys we can clearly see that the industry has researched and confirmed the need for a construction management degree program. (GBC, 2004)” “Factors such as the technology changes in the industry, the nonexistent pool of qualified construction management educated

professionals and the demand for qualified “construction engineering or management” (GBC, 2004)” professionals which is increasing in Canada and is evident in other countries. (GBC, 2004)” Figure 3, below shows the high priority skills/knowledge that was rated by the respondents of the members of the TCA.

Figure 3 - Respondents Who Rated Skills/Knowledge as "High Priority"





“During the planning and development of the program, George Brown College studied several applied degree models. (GBC, 2004)” “Applied degree programs offered by different jurisdictions within Canada and the United States were studied in more detail. In addition to the current offerings of such programs, further research was conducted with the following organizations (GBC, 2004)”:

- Quality Assurance Agency for Higher Education
- Canadian Engineering Accreditation Board (CEAB)
- Postsecondary Education Quality Assessment Board (PEQAB)
- Ontario Association of Certified Engineering Technologist & Technicians (OACETT)
- The Accreditation Board for Engineering and Technology (ABET)
- American Council for Construction Education (ACCE)

These organizations represent parallel developments and/or standards establishments in different jurisdictions. OACETT standards are defined at diploma level and since this proposal is at a degree level, it was found that the proposed standards for the degree program exceed that of the OACETT requirements. Currently, CEAB does not have developed documents and/or process for the applied degree level. (GBC, 2005)

“ABET has developed an assessment model for applied degree programs. This model is time tested in the United States and through bilateral and international agreements. (GBC, 2005)” ABET has defined applied degree levels in two broad categories: Associate and Baccalaureate levels. In addition, ABET also reviews program related standards while providing accreditation. In the

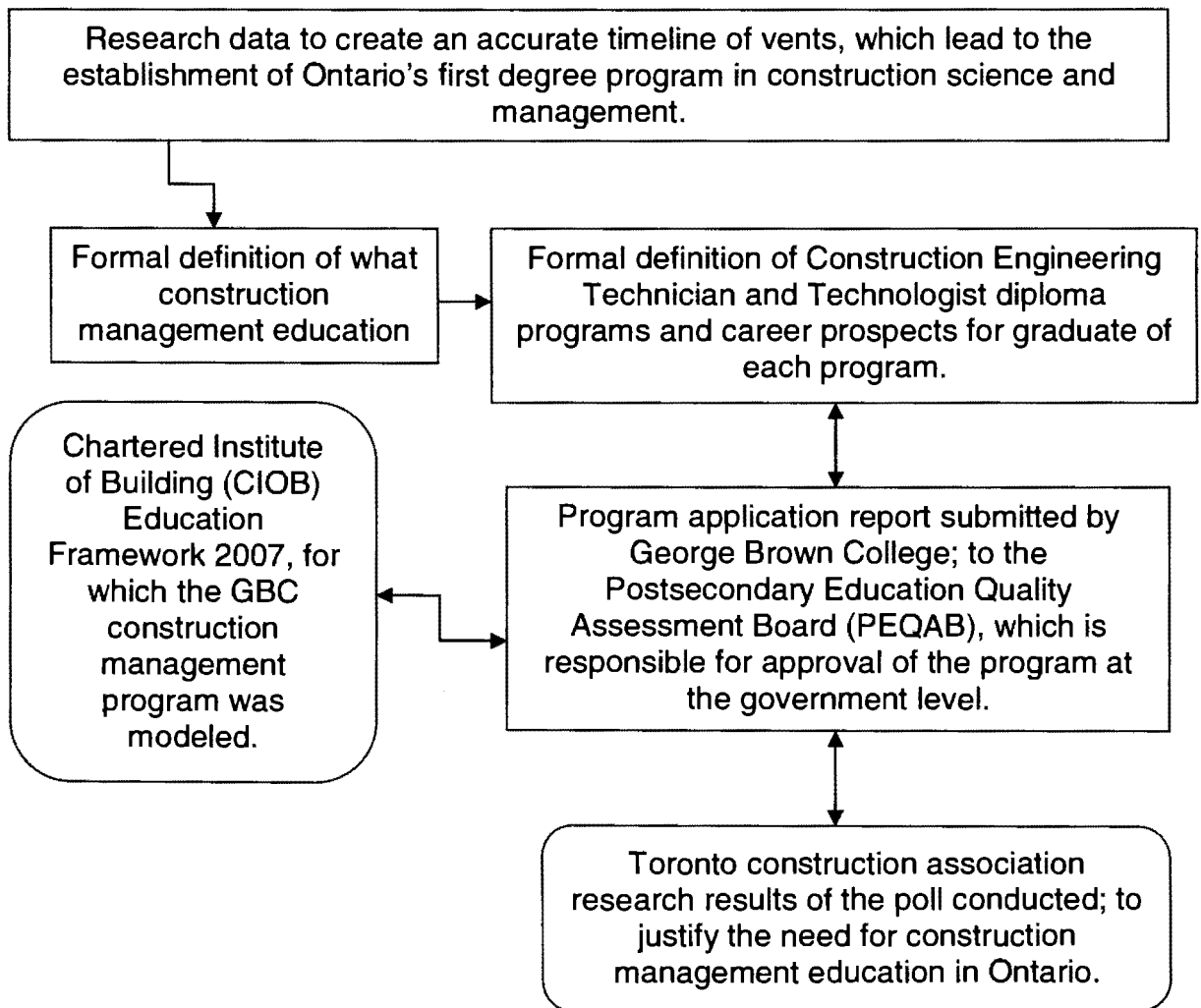
development of the Course Objectives, reliance was placed on the language and content guidelines provided by ABET, ACCE and PEQAB. (GBC, 2005)”

“The Construction Science and Management degree program at George Brown College meets or exceeds the PEQAB Degree Level Standards for baccalaureate degrees with an applied focus in every category. (GBC, 2005)”

### CHAPTER 3. RESEARCH METHODOLOGY

In order to develop an accurate description of what construction management education is, the research methodology for this paper will be built existing information that will provide an introduction to what construction management education is; therefore providing a clear understanding of the level of construction management education available both Canada and the U.S. The research methodology for this paper will include the following information as shown below in Figure 4, Research Methodology Flow Chart.

Figure 4 – Research Methodology Flow Chart



As part of the methodology, a formal definition and comparison of the available diploma programs in construction engineering technician and technology will be made. In addition, specific data will be collected and analyzed to display the situations that brought requirement for undergraduate construction management education into the vanguard of the construction industry in Ontario; and how this will affect existing construction diploma programs.

An examination of the educational framework of the Chartered Institute of Building (CIOB) will be made in order to provide a clear picture of the baseline created and used in developing the program. As well a review of the formal application package submitted by the Toronto Construction Industry and George Brown College for approval to the provincial government will be reviewed and analyzed to collect valuable research data.

By collecting the data and reports outlined above, a clear timeline of events will be created that will display the steps taken by the Toronto Construction Industry and the George Brown College faculty involved in the development of the program. In order to develop an accurate description of the events that were part of the development of the construction management program review of such data is necessary.

All this information will be the basis of the research methodology and will provide a clear picture of the current state of construction management education in Canada and more specifically Ontario.

## **CHAPTER 4. RESEARCH RESULTS**

### **4.1. The Planning and Development of One of the First Construction Management Degree Programs in Ontario**

In the year 2000, two specific circumstances brought the lack of construction management degree level education into the fore front of the Ontario construction industry:

- First, due to broader economic trends one of the major traditional sources of construction management skills into Ontario, the United Kingdom (UK) had become very limited.
- Second, the Ontario government was giving serious consideration to a system for licensing construction contractors.

“The contractors did not want licensing, preferring to control their industry themselves making a case for self-regulation. The industry studied the self-regulation model and decided to use the model for self-regulation already present in the form of the Chartered Institute of Building (CIOB) in the U.K. which regulates construction management higher education through a robust accreditation process and provides benchmark for quality through the Chartered Building Company and Consultants system. (Nichols, 2009)”

“As the primary transnational association for construction managers with a very large membership base, in many countries, the CIOB is the leading global organization dedicated towards the professionalism and education of those seeking a career in construction management (CIOB, 2007)”

“This self-regulation model gave the Ontario construction industry the confirmation that it too could self-regulate based on the model of the CIOB. The industry through the Toronto Construction Association (TCA) united and was successful in lobbying the Ontario government to drop the plan of licensing the industry, making the case for self regulation. (Nichols, 2009)”

The TCA observed that Canada was the only G7 country that did not have an undergraduate degree program in construction management, or any mechanism for ensuring continued professional development or international recognition of qualifications. As part of its self-regulation plan the industry decided to undertake two significant programs: the construction management degree program and The Construction Institute of Canada.

To illustrate the need, the TCA polled all its members with construction management degrees and discovered they were all granted offshore. In Ontario the closest thing to undergraduate construction management training was the curriculum for the construction engineering technologist programs, available at a number of community colleges and the project management degree option available through the architectural science program at Toronto’s Ryerson University.

This gave the TCA the impetus to set up a degree program in Ontario to meet the clear requests of the industry. The TCA agreed to lead the development of the curriculum for a degree level program. At the same time the Construction Institute of Canada (TCIC) was created to regulate education, ethics and discipline. The TCIC will eventually be a stand alone body like the American

Institute of Constructors (AIC) in the United States with a membership reciprocity agreement with the CIOB. “The TCA needed to locate a suitable education provider to deliver the degree program. Ryerson University and the University of Toronto were approached as a possible educational partner for the undergraduate degree program but both academic institutions declined at the opportunity. (Nichols, 2009)”

At the same time, the largest provider of construction management education at the diploma level in the province of Ontario was George Brown College (GBC) in Toronto. It was designated as a Centre of Excellence, it had a modern campus and it had a long standing connection to the CIOB. Their technologist diploma program had been accredited for the academic requirements of Licentiate Membership of the former IOB before the Royal Charter.

Around this time the provincial government of Ontario changed the law regarding post-secondary education. In 2000 the Post-secondary Education Choice and Excellence Act; allowed community colleges the opportunity to grant degrees, provided they didn't compromise existing program. Typically only universities under the previous legislation were allowed to grant degrees. Faculty of GBC being members of the TCA found out about the TCA's efforts and approached it with an offer to be academic partner to help develop the degree program.

It took four years to develop the program; the TCA formed an advisory committee to work closely with GBC faculty. This committee, still in existence

today, it is comprised of executives and owners of national construction companies and senior representatives of trade associations.

“The program was modeled on the CIOB’s educational syllabus, and contains a mandatory co-op component. The intent was always to gain accreditation from the CIOB and also the American Council for Construction Education (ACCE). CIOB and ACCE were consulted and the CIOB was invited to conduct a Pathfinder visit to the college at the expense of the TCA. CIOB members were prominent on the advisory committee and are also on the faculty at GBC. (Nichols, 2009)”

#### **4.2. Construction Science & Management Degree Program at George Brown College**

“The Construction Science and Management degree program from George Brown College (GBC, 2005)” is based on science and management theories which will produce graduates capable of effectively functioning in all construction settings, whether industrial, commercial, institutional, and residential or infrastructure revitalization. According to GBC, the program outcomes comply with codes, laws and regulations, while respecting sustainable environmental practices which are currently in place. “Graduates of this program will be able to address the requirements of the rapidly changing construction landscape, and with additional experience is able to assume positions as middle and senior managers. (GBC, 2005)” “Graduates will be able to continue their studies in the field of Business Management and specialized areas of the construction sector like green building, energy conservation and clean technology. (GBC, 2005)”



“The Ontario construction industry is becoming increasingly specialized and multifaceted; managing a successful construction project involves the skills of an orchestra conductor, in addition to those of the traditional site supervisor. (GBC, 2005)” “The orchestra conductor needs to interpret the musical score as it was intended to be played by the composer, co-ordinate the movements of various orchestral sections and individual musicians to remain on track, manage so that members of the orchestra are motivated and the audience happy, and complete the performance on time and within budget; as well as a solid education in modern building sciences. (GBC, 2005)” “Today’s Construction Manager requires concrete management and business training, including solid organizational, interpersonal and negotiating skills. (GBC, 2005)” “George Brown College designed the program which offers the only applied degree in Construction Science and Management in Ontario to include two specializations: (GBC, 2005)”

- Project Development
- Environmental Compliance

According to the program information gathered from George Brown College website, all students take the same courses for the first five semesters and must select their specializations before entering semester 6.

The Project Development specialization offer students with the understanding and ability to undertake management of tasks for the development of new projects, including but not limited to:

- New project proposal development & Pro-forma statements
- Project financing & Feasibility studies & Preparation of financial reports

- Planning and zoning proposals

The Environmental Compliance specialization offers students with the understanding and ability to undertake management of tasks, budget and schedule for environmental aspects of construction projects, including but not limited to:

- Preparation of environmental reports & Data management and presentation.
- Field investigation and environmental monitoring.
- Assisting with environmental studies and designs.
- Contributing by identifying environmental requirements in the tendering stages of a project
- Certifying contractual agreement with the contract documents.
- Contributing provision to certify contract compliance
- Conformance to requirements of environmental regulations by evaluating the work accomplished by consultants and contractors.

“Graduates of the construction science and management, program will receive academic credits toward a Professional Quantity Surveyor (PQS) designation from the Canadian Institute for Quantity Surveyors (CIQS) and 40 academic credits toward the Gold Seal certification offered by the Canadian Construction Association (CCA).(GBC, 2005)”

Graduates from this program are well positioned to receive credential recognition from:

- Canadian Council of Technician and Technologists (CCTT).
- Ontario Association of Certified Engineering Technicians and Technologists (OACETT).

- Ontario Building Officials Association (OBOA).

“The Canadian Engineering Accreditation Board (CEAB), the Accreditation Board of Engineering and Technology (ABET), and the American Council for Construction Education (ACCE) will be further consulted for credential recognition prior to the third year of delivery and as per their individual guidelines. (GBC, 2005)” “George Brown College is keenly aware of the need for program accreditation and graduate recognition.

Below is the current course calendar for the Construction Science and Management Bachelor of Applied Technology degree program. (GBC, 2005)”

### **Course Calendar (GBC, 2005)**

#### **Year One, Semester 1**

ADMN1001 - Industry Practices  
 BLDG2103 - Science of Architecture  
 BLDG1151 - Construction Technology I  
 – Housing and Small Buildings  
 COMM1151 - Communications (PBL)  
 GHUM2106 - History of Architecture  
 MATH1151 - Technical Mathematics  
 and Physics

#### **Year One, Semester 2**

BBUS1007 - Macroeconomics: Canada  
 in the Global Environment  
 BLDG1162 - Building Code Act and  
 Regulations  
 BLDG2108 - Portfolio I (first 7 weeks)  
 BLDG2102 - Health and Safety (second  
 7 weeks)  
 BLDG2201 - Construction Technology  
 II – Materials and Geophysical Science  
 BSCI2101 - Building Science I –  
 Fundamentals  
 MATH1251 - Mechanics – Strength of  
 Materials

#### **Year Two, Semester 3**

ADMN1101 - Zoning and Site  
 Engineering  
 BLDG2101 - Construction Science –

#### **Year Two, Semester 4**

BLDG2105 - Construction Estimating –  
 Pricing  
 BLDG2104 - Mechanical and Electrical

Foundations and Structures  
BSCI1001 - Building Science II –  
Components and Separators  
GSCI1200 - Sustainable Development  
and the Environment  
MATH2101 - Quantity Surveying and  
Estimating  
GNED – Elective

Services and Systems  
BLDG2202 - Construction Technology  
III – Industrial, Commercial,  
Institutional, Civil  
MGMT3101 - Project Management and  
Scheduling  
GNED - Elective

### **Year Three, Semester 5**

ADMN3201 - Plan Examination and  
Inspection  
BBUS1006 - Microeconomics: Canada  
in the Global Environment  
BLDG3025 - Construction Estimating –  
Bidding Procedures  
BLDG2106 - Structural Systems  
Analysis (Engineering Reinforced  
Concrete)  
BLDG3050 - Construction Site  
Engineering Management (Supervision)  
BLDG3108 - Portfolio II  
GNED - Elective

### **Year Three, Semester 6**

ADMN3202 - Quality Assurance –  
Specifications  
\*BLDG3150 - Construction Cost Control  
\*\*ENVR1151 - Environmental Science  
HRM4101 - Labor Relations and HR  
Management  
LAW1151 - Law and Construction  
Contracts  
MGMT3150 - Construction Project  
Management  
COMM3101 - Foundations in Research  
GNED - Elective  
BLDG3101 - Work Experience (summer  
semester)

**\*Project Development Specialization.**

**\*\*Environmental Compliance Specialization.**

### **Year Four, Semester 7**

ADMN4201 - Risk Management  
BLDG3164 - Applications in Research  
\*BLDG3151 - Construction Law – Case  
Studies  
BLDG3152 - Cost Planning and  
Administration  
\*BLDG3201 - Development Economics

### **Year Four, Semester 8**

\*\*ADMN3101 - Building and Site  
Assessment  
ADMN4202 - Quality Management  
Systems  
\*ADMN4150 - Project Monitoring  
ADMN4151 - Project Management –  
Practicum

\*\*ENVR3101 - Sampling, Monitoring and Testing

ENVR3202 - Integrated Data Management

LAW3201 - Environmental Protection Legislation

\*\*LAW4101 - Enforcement and Compliance

\*MGMT4050 - Project Procurement

MGMT4051 - Leadership Development

\*BLDG4051 - Innovation and Constructability

BLDG4150 - Capstone Industry Project (independent study)

COMM3150 - Business Practices and Communication

COMM4201 - Professional Ethics

\*\*ENVR3201 - Environmental Assessment and Planning

**\*Project Development specialization.**

**\*\*Environmental Compliance specialization.**

Course Descriptions for this program can be found in Appendix A.

## CHAPTER 5. CONCLUSIONS

Construction Management education is a relatively new academic discipline that recently has been implemented by many university and colleges in both Canada and the US. In Canada, and more specifically the province of Ontario; undergraduate construction management education had been non-existent until very recently. Many factors came into effect back in the year 2000 that prompted the Ontario construction industry to review and reflect on its future talent pool.

From the research results, the research paper clearly displays that the Ontario construction industry was forced to review its involvement with local academic institutions mostly due to two important factors. The stream of supply of construction management degree professionals had become very limited due to broader economic trends. Also government of Ontario was considering regulating and licensing contractors. "These two factors prompted the industry to take the lead in securing its future talent pool with locally educated construction management graduates, while at the same time making a successful case for self-regulation. (Nichols, 2009)"

One of the first steps in developing the construction management degree program was to see the real need for such a program from its own industry members. The industry conducted a poll of its members to display the need for such an educational program. The poll results were positive and clearly displayed the necessity for a degree program in construction management. These acknowledge requirement put the wheels in motion and the industry began to plan and develop the program with an academic partner found in George Brown

College. "As an educational partner GBC took the care of securing provincial approval from the Post-secondary educational quality board. GBC and the industry also consulted with the CIOB. (Nichols, 2009)" "The program was modeled on the CIOB's educational syllabus, and contains a mandatory co-op component; the CIOB was invited to conduct a Pathfinder visit to the college at the expense of the TCA to review the proposed program. (Nichols, 2009)"

It took four year to develop the program and this successful partnering between the TCA and GBC came to a successful conclusion when on April 2005, George Brown College (GBC) and the Construction Industry announced the establishment of Ontario's only Construction Science and Management bachelor degree program.

In conclusion, for construction management educational program; like the construction science and management program at GBC to be established and continue to grow, three things are needed.

First there must be a need within the industry at a provincial or national level for this type of industry specific program. Second there must be an education institution that can act as a provider capable of delivering the program. For this you need a partnership with the industry because the educational institution must teach what the industry requires. The industry must offer their knowledge and expertise in the form of part-time professors to pass their specialize knowledge on to the next generation, irrespective of company affiliation.

"Finally you need an organization that can act as a patron with vast financial resources that can be a financial partner for this type of programs (Nichols, 2009).

## **5.1. Significance of the Research**

This research has its significance as it shows how construction management degree programs are a much needed academic discipline that will fuel the construction industry with its much needed future construction professionals. This research contributes to the research in the field of construction management education as it displays the growing and development field of construction education in Canada as well as the U.S. In construction, perhaps the most powerful tool is education. In particular, “construction management programs are essential in helping this industry continue to grow and prosper for the long term. (Rosenbaum, 2001)” The significance of this research shows that industry involvement, leadership and continuous support is needed in order for these programs to be developed, established for the benefit of the industry itself.

## **5.2. Recommendations**

For further research, it is recommended that further assessment and evaluation research can be done on how the new planned and developing construction management programs are currently planned and progressing in other provinces in Canada. Also a further research can be done on the established construction management programs at GBC, BCIT, the future research areas can included current and future progress, proposed developments and adjustments done or planned since the programs were established. Also further research can be done on any new graduate programs in construction management program being planned and developed in other provinces.



## REFERENCES

- British Columbia Institute of Technology. (2010). Available at:  
<http://www.bcit.ca/study/programs/8800btech> (Accessed 1 June 2010).
- Bernold, L. E. (2005). "Paradigm shift in construction education is vital for the future of our profession." *J. Constr. Eng. Manage.*, 131(5), 533–539.
- Bilbo, D., Burt, R., Collins, C., & Waseem, M. (2007). A study of the supply and demand for construction education graduates. *ASC International Proceedings of the 43rd Annual Conference (327-337)*. Northern Arizona University – Flagstaff, AZ.
- Chartered Institute of Building, 2007, *Education Framework*, CIOB, Ascot, Berkshire.
- George Brown College of Applied Arts and Technology. (2004). Proposal for Bachelor of Applied Technology Construction Science and Management. Toronto, ON: Dr. Marjorie McColm.
- George Brown College of Applied Arts and Technology. (2005). Available at:  
[http://www.georgebrown.ca/degrees/construction\\_science\\_main.aspx](http://www.georgebrown.ca/degrees/construction_science_main.aspx)  
(Accessed 1 June 2005)
- Gilbert, R. (2008, March 17). Southern Alberta Institute of Technology plans construction management program. *Journal of Commerce*, pg. 4.
- North Dakota State University (2007). Available at:  
[http://www.ndsu.nodak.edu/ndsu/academic/factsheets/eng\\_arch/constman.shtml](http://www.ndsu.nodak.edu/ndsu/academic/factsheets/eng_arch/constman.shtml) (Accessed December 2010)
- Nichols, B. (2009). Starting From Scratch. *International Construction Review*, Issue 13, Quarter 4, 2009.
- Ontario Association of Certified Engineering Technicians & Technologist (2005) Available at [http://www.oacett.org/page.asp?P\\_ID=108](http://www.oacett.org/page.asp?P_ID=108). (Accessed December 2010)
- Postsecondary Education Quality Board (2009) Available at:  
<http://www.peqab.ca/legislation.html> (Accessed 17 May 2010).
- Russell, J.S., Hanna, A., Bank, L., Shapira, A., "Education in Construction Engineering and Management built on Tradition: Blueprint for Tomorrow". *J. Constr. Eng. Manage.* 10.1061/ (ASCE) 0733-9364(2007)133:9(661).

Rosenbaum, D. B. & Rubin, D. K. (2001, October 29). The nation's C-Schools, special report on construction education. *Engineering News-Record*, New York: McGraw-Hill. 247 (18), 26-37.

Red River College of Applied Arts, Science and Technology. (2010). Available at: <http://me.rrc.mb.ca/Catalogue/ProgramInfo.aspx?ProgCode=CONMF-DG&DescriptionType=19&RegionCode=WPG> (Accessed 15 August 2010).

Riggs L.S., 1988, Educating the construction manager, *Journal of Construction Engineering and Management*, 114, 2, 279–285.

## **APPENDIX A**

### **George Brown College - Bachelor of Applied Technology: Construction Science and Management Course Descriptions**

#### **ADMN1001 - Industry Practices**

“Students develop contacts and knowledge regarding hiring practices and career opportunities in the construction industry, as well as familiarity with industry terminology, development practices, standards and codes and documents. This course introduces the students to building-related industries including construction industry regulated practices. (GBC, 2005)”

#### **BLDG2103 - Science of Architecture**

“This course is designed to introduce students to the science and art of Architecture; students understand the interdependence of architectural and engineering disciplines in the design process. (GBC, 2005)”

#### **BLDG1151 - Construction Technology I – Housing and Small Buildings**

“Wood frame construction techniques are demonstrated and discussed. This course introduces the building technologies associated with small housing and buildings and provides as a core component reading and interpreting construction related drawings. (GBC, 2005)”

#### **COMM1151 - Communications (PBL)**

“This course develops appropriate college-level communication, teamwork, problem-solving, critiquing, and self-assessment skills to enable them to participate fully and successfully in their program courses. Working within a small-group and using a student-directed, problem-based learning approach, students will actively discover and present course material to one another. (GBC, 2005)”

### **GHUM2106 - History of Architecture**

“The history of building from prehistoric times to the twenty-first century is introduced, highlighting the most significant and influential architectural periods, styles, buildings and technologies. (GBC, 2005)”

### **ADMN1101 - Zoning and Site Engineering**

“This course consists of a theory lecture portion and survey lab component. The Zoning By-laws theory emphasizes the interpretation and use. Students apply sections of zoning by-laws to construction projects. (GBC, 2005)”

### **BLDG2101 - Construction Science – Foundations and Structures**

“In this course students explore construction site engineering, shallow and deep building foundations, and structures including the selection of technical systems of earth-works, excavation, shoring and dewatering. Some specific topics that will be examined include heavy construction, piling, super-structure systems and materials. Foundation and structural system drawings are analyzed by relating them to geophysical science, current construction methodologies and practices. (GBC, 2005)”

### **BSCI1001 - Building Science II – Components and Separators**

“This course examines construction science concepts and methodologies applied to the building enclosure, with respect to energy efficiency, durability, indoor air quality and sustainability. (GBC, 2005)”

### **GSCI1200 - Sustainable Development and the Environment**

“Through the study of the movements of air, heat and moisture and their impact on the building systems of the environs, the building envelope, the mechanical

systems and the occupants, students will gain insight into the interaction of these physical forces and building systems. This course deals with the study of assembly of interacting systems and the environmental consequences buildings. (GBC, 2005)”

### **MATH2101 - Quantity Surveying and Estimating**

“The principles of Quantity Surveying and estimating are explored as a profession and as defined by the Canadian Institute of Quantity Surveyors (CIQS). Course focuses on industry terminology, types of estimates, the process of estimating and measurement principles as well as highlighting the important roles that the estimator and quantity surveyor play in the various stages of a project. (GBC, 2005)”

### **ADMN3201 - Plan Examination and Inspection**

“This course investigates the Ontario Building Code Act (OBC) and Regulation Divisions B 3, 10, 11. Emphasis is paid to large and complex buildings that do not fall within Part 9, Housing and Small Buildings. Students learn the requirements for barrier free design, change of use and renovations. (GBC, 2005)”

### **BBUS1006 - Microeconomics: Canada in the Global Environment**

“The application of Microeconomic basic principles, concepts to current economic actions, where the study of principles of supply and demand, consumer behavior, utility maximization, cost of production and profit- maximization are studied. (GBC, 2005)”

### **BLDG3025 - Construction Estimating – Bidding Procedures**

“This will provide the awareness and abilities essential to apply the processes of estimating construction from bid preparation to analysis and continues with the concepts learned in Construction estimating - Pricing. Students analyze and apply unit prices of labor, material and equipment to estimate and schedule construction work activities in a case study/project-based format for various construction contract types. (GBC, 2005)”

### **BLDG2106 - Structural Systems Analysis (Engineering Reinforced Concrete)**

“This course discovers the engineering and architecture of building structures. Wood-frame, steel-frame, masonry and reinforced concrete structural, engineered-wood systems of buildings are investigated with a perspective from design to construction. (GBC, 2005)”

### **BLDG3050 - Construction Site Engineering Management (Supervision)**

“Students examine and synthesize the factors involved in the organization and management of projects including the various resources available on the site. Key construction management principles are applied in project start-up, jobsite layout, project inspection and quality control. (GBC, 2005)”

### **BLDG3108 - Portfolio II**

“This course prepares students to undertake a job search using relevant methods including internal college resources and the capability to communicate their professional goals. Students develop and refine specific tools towards creating a career portfolio that supports their upcoming and co-op career searches. This

includes self-assessment, resumes, cover letters and other employment messages. (GBC, 2005)”

### **ADMN4201 - Risk Management**

“Students learn to develop necessary skills needed to provide proper problem solving solutions. The need to assess risk, manage risk and reduce liabilities is the main subject matter of this course. (GBC, 2005)”

### **BLDG3164 - Applications in Research**

“Applications in Research are a preparatory and prerequisite course for the completion of the Capstone Industry Project, which will be completed the following semester in the Industry Capstone Project course, BLDG 4150. The focus of Applications in Research is on the research aspects of the capstone project. Students will first conduct the secondary research required for the selection of a research topic. (GBC, 2005)”

### **BLDG3152 - Cost Planning and Administration**

“Concepts are examined as practical to cost planning and cost control methods during the various phases of a project. The necessity for cost control during the design stages of project development. Factors influencing costs, conceptual and preliminary estimating methods and Elemental Cost Analysis (ECA) will be analyzed and applied. (GBC, 2005)”

### **BLDG3201 - Development Economics**

“Students synthesize the concepts of economics development as accomplished by a various different construction professionals. Students use preliminary estimating

and outline specifications as applied to feasibility studies, mortgages, raising capital and life cycle costing. (GBC, 2005)”

### **ENVR3202 - Integrated Data Management**

“Using 3D or 4D visual Building Information Modeling (BIM) students relate information and data linked to a virtual model of the building. Students will utilize this information to allow cost and scheduling to be linked to the model. Students gain hands on experience with the software and create flow line schedules using BIM information. (GBC, 2005)”

### **MGMT4050 - Project Procurement**

“In this course students critically analyze the various modes of procurement and Project Delivery Systems (PDS) including stipulated sum, design build, construction management, cost plus, Public / Private Partnerships (PPP) and turnkey. Students present, critically analyze and prepare written materials relating to current procurement methods. (GBC, 2005)”

### **MGMT4051 - Leadership Development**

“This course provides a practical understanding of the key elements of effective leadership as well as the leadership challenges typically encountered in today's work environment. Drawing on information from The Art of Leadership text, as well as other resources, both theory and application of successful leadership behaviors are explored and reinforced. (GBC, 2005)”